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Dewpoint Temperature Inversions Analyzed

A report which discusses dewpoint temperature inversion with regard to other simultaneous meteorological conditions has been presented. Data on solar radiation and net radiation flux, air and dewpoint temperatures, relative humidity, soil temperatures, wind speed and direction, and pressure were examined to establish the influence of meteorological variables on the variation of dewpoint temperature with height. Five years of hourly observations, from December 1, 1960 through December 31, 1965 were used.

The objective of this study was to present data on the climatology of vertical dewpoint profiles as determined by dewpoint temperature differences for the 1.2- and 9.4-ft. levels and the 1.2- and 131-ft. levels. The report covers instrumentation and available data, all the climatological features of dewpoint inversions, and specific case studies.

Dewpoint inversions (where the moisture increases rather than decreases with height in the first several hundred feet above ground) are a fairly common occurrence. In winter, as many as 41% of the hourly readings showed a dewpoint inversion between the 131- and 1.2-ft. levels. In summer and fall, 22 and 21% of the observations, respectively showed inversion conditions. The dewpoint inversions occur most frequently at night, with their onset around sunset and disappearance shortly after sunrise.

The observed variation of dewpoint temperature with height is markedly affected by conditions which lead to condensation on or evaporation from the ground surface. A dewpoint inversion will develop if the ground acts as a sink to remove water vapor, which it does whenever it cools to a point where condensation takes place or if it is hygroscopic. During windy conditions the lower layers are well mixed preventing strong cooling in the lower layers because warmer air is continually brought down from above. Thus, dewpoint inversions would be expected to form more frequently under light wind conditions, all other factors being equal.

The frequency of occurrence of other conditions contributing to the development of dewpoint inversion are also detailed and explained in the report. Strong outgoing net radiation, temperature inversions, relative humidity exceeding 80% and light winds all influence dewpoint inversion.

At the meteorological installation, the hourly data were recorded not only on pen and ink charts, but also on paper-punch tape and on a teletype printout. The paper-punch tape was converted to EAM cards and magnetic tape for computer processing.

The dewpoint measurements were obtained by Foxboro Dewcels at 1.2, 9.4, and 131 feet on the meteorological tower. These instruments have an absolute accuracy of about 3°F and a greater relative accuracy. Vertical temperature gradient measurements were obtained by copper-constantan thermocouples measuring the difference between temperatures at 5.5 and 144 ft. New radiation flux measurements were obtained with a radiometer 6 feet above ground. Three-cup anemometers were used for measuring wind speed at 19 feet above ground.

Notes:

1. Further information is available in "Dewpoint Temperature Inversions," *Meteorological Studies*, pp. 149-160, by W. C. Ashby, Harry Moses, and Mary A. Bogner.
2. Inquiries concerning this report may be directed to:

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(continued overleaf)

Patent status:

Inquiries about obtaining rights for commercial use of this innovation may be made to:

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